Monthly Status Report • August 2010
Covering the Period 1 August through 31 August 2010

POWER MEMS DEVELOPMENT

Contract N00014-09-C-0252
Submitted in accordance with Deliverable A001 - Monthly Technical and Financial
SRI Project P19063

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MEMS RESETTABLE CIRCUIT BREAKER (TASK 1.1) AND MEMS SWITCH FOR DC-DC VOLTAGE CONVERTERS (TASK 1.2)

Task 1.1 Contributors: Sunny Kedia, Weidong Wang, Susana Stillwell

Task 1.1 Deliverable: 10 prototype packed MEMS-based resettable circuit breakers for testing and analysis in ONR laboratories.

Task 1.2 Contributors: Sunny Kedia, Shinzo Onishi, Scott Samson, Drew Hanser

Task 1.2 Deliverable: Functional MEMS-based DC-DC converter in a vacuum package.

Summary: In Task 1.1 we wafer-bonded a silicon-on-insulator (SOI) wafer and a double-side polished (DSP) silicon wafer, then released and tested devices from this bonded wafer pair. After release, we determined that the cantilever devices forming the circuit breaker switch were in a normally closed position due to high intrinsic stress in the thin-film layers. We measured the resistance of heater elements in these devices, which were in agreement with the expected theoretical values. We performed current and voltage testing on the circuit breaker devices and observed the thermal operation of the switches. Further plans for device processing include reducing the impact of the intrinsic stress in the thin films and producing normally open switches.

In Task 1.2 we identified design issues in the Version 2.0 (V2.0) device design following flip-chip bonding experiments. The V2.0 design was designed to tolerate ± 5 μm of bonding misalignment, whereas experimental results show flip-chip bonding misalignment up to ± 25 μm. Because of this larger misalignment, devices on bonded chips do not actuate as expected following bonding. We redesigned the layout of metal layers in two of the device masks to accommodate this higher level of flip-chip misalignment while still providing device actuation. Devices using this new V2.1 design will be fabricated and tested next month.

DIAMOND HEAT SPREADER OR HEAT SINK FOR HIGH-POWER MEMS SWITCH APPLICATIONS (TASK 1.3)

Contributors: Priscila Spagnol, Shinzo Onishi, Drew Hanser, Weidong Wang, Sunny Kedia, John Bumgarner

Deliverable: Prototype device fabricated on a thin-film diamond heat spreader layer and individual samples of diamond on Si or other suitable substrates for material evaluation.

Summary: No work was done this month on Task 1.3.

POSITRON TRAPPING AND STORAGE (TASK 2)

Contributors: Ashish Chaudhary, Friso van Amerom, Tim Short

Deliverable: A minimum of four MEMS-based trap structures for RF trapping of electrons

Summary: We fabricated two additional electron trap structures using the established wafer fabrication process. We will test these structures next month with a new flange that is designed to reduce the penetration of the high voltage potential into the electron trapping region.

FINANCIAL STATUS

R&D Status Report

Program Financial Status

15 July 2009 through 28 August 2010

Contract Item No.	Current Funding	Current Period Expenses	Cumulative Expenses	% Budget Complete
0001	$1,829,849	$88,666	$1,300,341	71%
Project Commitments		0	242,882	
Total	$1,829,849	$88,666	$1,543,223	

Based on currently authorized work:

Is current funding sufficient for the current fiscal year (FY)? (Explain if NO) **Yes**

What is the next FY funding requirement at current anticipated levels **N/A (base fully funded)**